Manufacturing Near-Net-Shape Conformal Electro-optic Sensor Window Blanks from Spinel

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The official link for this solicitation is:
http://www.acq.osd.mil/osbp/sbir/solicitations/sbir20152/index.shtml

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Description:

Electro-optic sensor windows that conform to the local shape of an aircraft mold-line are desirable for future air platforms to allow for a large sensor angle of regard. Conformal shapes may have little to no symmetry depending upon their location. Spinel is an excellent material candidate as it is both durable and multi-spectral (ultraviolet through mid-wave infrared). Spinel is more erosion resistant than multispectral zinc sulfide, which is another logical candidate for a large conformal window. The availability of blanks currently limits the size and curvature for potential window applications. The objective of this project is to develop and demonstrate new manufacturing processes to provide near net shape blanks to improve upon current state of the art processes which start with a thick, planar blank and grind them to the desired shape. Currently, the thickness of the planar blank limits the maximum sag (height of window from highest to lowest point) that can be obtained to approximately one inch. Although actual shapes will be chosen by mutual agreement with the government, it is expected that the approximate conformal shape for Phase II will be 16x16 inches with a sag of six inches. A small grain spinel is preferred for enhanced strength, which is a desired property. PHASE I: Demonstrate feasibility to manufacture near net shape conformal electro-optic sensor window blanks from spinel. To prove feasibility, produce a minimum of two uncracked, fully dense spinel window blanks having final fired dimensions of at least a 6x6inch footprint, sag of three inches, and thickness of ½ inch. A toroid is a possible demonstration shape. Measure the transmission spectrum

of the material using polished flat specimens cut from one of the window blanks. Desired transmission is within 4% of the theoretical value for spinel at a wavelength of 0.63 microns and within 2% of the theoretical value for spinel at a wavelength of 4 microns. PHASE II: Scale up to produce a minimum of two uncracked, fully dense spinel window blanks having final fired dimensions of at least a 16x16inch footprint, sag of six inches, and thickness of one inch. Demonstration shape may be a toroid or other free-form shape mutually agreed upon with the government. Measure the transmission spectrum and flexure strength of the material using polished flat specimens cut from one of the window blanks. Desired transmission is within 4% of the theoretical value for spinel at a wavelength of 0.63 microns and within 2% of the theoretical value for spinel at a wavelength of 4 microns. A material strength of greater than 200MPa is desirable, as measured by ring-on-ring flexure testing. PHASE III: Implement manufacturing processes for commercial production and commence full rate production in order to support Navy requirements. Assist the Navy in transitioning this technology to identified platforms.